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THE COLUMBIA RIVER BASIN

Public Health Service
San Francisco, California

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REPORT ON

THE COLUMBIA RIVER BASIN

for the

PRESIDENT'S WATER RESOURCES POLICY COMMISSION

Prepared by the

Pacific Northwest Drainage Basins Office
Division of Water Pollution Control

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THE COLUMBIA RIVER BASIN

PART I

PHYSICAL AND ECONOMIC DATA

Description of the Basin

From its point of origin in a Canadian mountain lake 270 miles above the International Boundary, the Columbia River flows more than 1200 miles to the Pacific Ocean. In spite of many irregularities in its course because of the mountainous regions of the basin, general direction of flow is southerly and westerly. More flattened areas occupy the Snake River Plain, the 100,000 square mile Columbia Plateau and the southern extension of the Puget Sound Trough. The watershed area is bounded on the east and north by the Continental Divide, on the northwest by the Cascade Range, on the southwest by the Coast Range and on the south by the Great Basin Divide. Peaks in some of these mountains are 12,000 feet high. In addition to the 39,500 square miles of drainage area in British Columbia, 220,000 square miles are in Idaho, Oregon and Washington, western Montana and small sections of Nevada, Utah and Wyoming.

South of the International Border, the basin population, as estimated for 1947, is 2,606,647. This is an increase of 18.6 percent since 1940. More than half the basin people live in rural areas with the remainder distributed among the six major cities and many smaller communities. Because rugged wilderness regions are almost uninhabited, population distribution by area is notably irregular. Concentrated populations in the Yakima and Willamette Valleys have been attracted by fertile lands and water for irrigation.

Four basic resources - agricultural lands, forests, minerals and water - are responsible for tremendous economic developments. These give rise to the principal industries of farming, logging and lumbering, mining, hydroelectric power production and fishing. Of these, farming is by far the most important economically and will be greatly augmented by irrigation developments now under construction and those proposed. About forty million acres are in farms, and over one-fifth of this area is in crop land. About one-half of the cropland is irrigated and developments now underway will augment this irrigated area by more than one third. Nearly

three-fourths of the basin employment can be traced either directly or indirectly to the basic resource of agricultural land.

Lumber production in the Pacific Northwest in 1943 accounted for more than one-third of the Nation's total production.

Mining is an important industry in some parts of the basin. The Coeur d'Alene district of Idaho includes the most productive silver mine and the second most productive lead mining district in the Nation. Butte, Montana, is the center of one of the world's greatest copper-producing districts. Other mining activities are more evenly distributed over the basin's mountainous areas.

Columbia River is potentially one of the greatest power-producing streams of the world. Hydroelectric power plants installed and under construction will provide a capacity of more than 4.5 million kilowatts. Potential power developments of Columbia River in the United States will have an installed capacity of about 11 million kilowatts.

Because of the great abundance of water of suitable quality and the hydroelectric power potentials of the area, a nuclear fission reactor plant of considerable importance to the future security of the Nation is located on the main stem of the river in an isolated area of the Columbia Plateau. Another nuclear fission reactor plant of considerable importance is now under construction in an isolated section of the Snake River Basin, a major tributary of the Columbia River. Columbia River and its tributaries support an important fishery industry based upon the commercial catch of salmon which migrate up river to spawning grounds along the main stem and its tributaries. The runs of these anadramous fish have been greatly decreased by high dams, logging operations, pollution and other factors that interfere with normal fish propagation. An intensive sport fishery also exists throughout the basin.

The recreational resources of the Columbia Basin are equal to those possessed by any other area in the Nation. Three national parks - Yellowstone, Glacier and Mt. Rainier - lie partly within the basin, and one - the Grand Teton - lies wholly within the basin. Many recreational facilities have been provided by private enterprise and Federal and State agencies. Three national monuments and seventy-five State parks are also located in the basin.

Basic hydrologic data are deficient for many of the Columbia tributaries with the majority of the measuring stations having records of only short duration. This lack of dependable stream flow data makes it difficult to evaluate accurately the self-purification characteristics of many streams. In streams west of

the Cascades greatest variation in seasonal run-off occurs. High water in these streams may occur frequently as a direct result of run-off from rainfall. In the streams east of the Cascades high water usually occurs during a continuous period of several month's duration. The forest cover at high elevations, together with the slow melting of heavy snows, regulates the run-off to some extent and helps to provide valuable summer-time flow in the larger streams. Serious floods of the Columbia, when they occur, frequently are caused by excessive snow melt during warm weather early in the season. The average flow of Columbia River at The Dalles in Oregon is 195,000 c.f.s., the minimum is 35,000 c.f.s. and the maximum recorded for any flood stage is 1,170,000 c.f.s.

Unpolluted waters of the Columbia watershed are satisfactory for all existing and potential water uses. This water is soft and desirable for domestic and industrial use. A few streams, such as the Palouse River, carry extremely large sediment loads during the heavy run-off periods. Even in some of the smaller streams there frequently is an impairment of water uses by suspended material during high flows. A few streams have been lost to all but limited industrial use because of pollution from mining wastes. In other streams, such as the Willamette River, heavy industrial waste loads have greatly impaired most normal water uses.

The water resources of Columbia River occupy a key position with reference to the area's present and future economic development. Adverse effects from the discharge of large amounts of industrial and domestic wastes into the Columbia River and its tributaries require prompt and effective control of this pollution to prevent interference with future economic development of the Basin.

the report discusses this

Source of Pollution

The Columbia River and its tributaries receive the waste discharges from 267 municipalities and 391 industrial plants. The extent of pollution is indicated in the following table:

Amount of Pollution Contributed

Source	Number	Estimated No. of People Served c/	Pop. Equivalent of Wastes Discharged to Watercourse d/
Municipalities a/	267	1,420,065	2,022,596
Industrial Plants b/	391	---	6,803,000*
Total	658	1,420,065	8,825,596

* The Population Equivalent of wastes discharged includes an estimate for 316 of the basin's industrial plants where surveys have not yet been completed. The estimated Population Equivalent of 6,803,000 has been derived by adding to the known industrial pollution Population Equivalent, 6,252,587, an estimated amount of 551,000 for these 316 plants.

a/ Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, towns, significant institutions, resorts or other population centers with sewer systems. (This pollution includes the industrial wastes discharged into municipal sewerage systems.)

b/ Industries discharging wastes directly to watercourse.

c/ Latest estimated population connected to sewers.

d/ In reducing to a common basis certain wastes from industries and municipalities, it is a common practice to express the non-similar wastes in terms of a common unit, Population Equivalent. This expression does not include wastes of a toxic or inert nature.

Polluting wastes reaching the Columbia River and its tributaries are equal in effect to the raw sewage from about 8,825,596 persons. About 77 percent is contributed by industries in the basin. In addition to industrial wastes that contain putrescible organic matters of sewage-like character, others contain toxic and otherwise objectionable substances such as mining wastes, logging and sawmill wastes, silt, oil and other complex compounds

Thousands of tons of mine tailings from lead, copper, zinc and other mining operations and from coal washeries are dumped into the river and its tributaries daily. Treated radioactive wastes are discharged in the basin also.

The Willamette River in Oregon is perhaps the most heavily polluted stream in the Pacific Northwest. More than eight hundred thousand people reside in this watershed. Raw sewage from most of this population presently is discharged into the river and its tributaries. In addition, industries - principally pulp and paper mills - discharge wastes with a Population Equivalent of more than three million. Wastes from people and the industrial establishments in the Willamette watershed have degraded this stream to the point where most normal water uses are prohibited during certain periods of the year.

Some important fishery streams have been partially blocked by logging operations, and saw mill log ponds have impaired the utility of many streams.

Large quantities of silt are washed into streams of the basin from farm lands and sand and gravel mining operations. More than fourteen million tons of silt were removed by dredging from the Columbia River Drainage Basin during 1949. (1)

Water Use and Adequacy of Water for Indicated Uses

About one million persons obtain their drinking water from the Columbia River and its tributaries. The drinking water demand is estimated at more than one hundred million gallons per day. Industries are estimated to use several times this amount. Because most municipal water supplies are obtained from unpolluted tributaries of the Columbia, extensive treatment is not required. This is not the case with industries, however, because most of the larger ones obtain their supplies from rivers adjacent to areas of concentrated population. In many instances they must provide more extensive treatment.

Locations of greatest stream degradation are in the Clark Fork River above Missoula, Montana, the Coeur d'Alene River above Lake Coeur d'Alene in Idaho, and the Columbia and Pend Oreille Rivers above Lake Franklin D. Roosevelt. In certain portions of some of these streams tailings and other mine wastes have rendered

(1) Source of Information: Corps of Engineers.

the water useless for any purposes other than industrial processing. Coeur d'Alene, Idaho, a community of 12,000 people, obtains its water from Coeur d'Alene Lake where lead concentrations have been found to be excessive at times.

Other stream degradations are found in highly developed irrigation areas below communities discharging raw or partially treated sewage and industrial plant wastes. Because of the tremendous water requirements for irrigation in these areas, nearly all of the stream flows are diverted during the late summer and early fall months so that little water remains for the dilution and natural purification of sewage. In a number of places the sewage and industrial wastes are diverted from drainage courses for irrigation use. Principal areas where these conditions exist are in the Upper Snake River Basin, in the Central Snake River Basin below Boise, Idaho, and in the Yakima River Basin in Washington.

There are a number of other locations in the basin where pollution is of much concern because of its interference with many of the normal water uses.

Need for Treatment Works

The requirements for sewage and industrial wastes treatment plants are shown in the following table. Available data indicate that 108 new treatment plants and 78 enlargements are required by the municipalities of the basin. New information resulting from present and future studies will undoubtedly show that this estimate of needs is low.

Sewage and Industrial Waste Treatment Plant Requirements

Source (1)	Total No. (2)	Without Treatment			With Treatment			No Project Req'd (9)	No Data (10)
		No. (3)	Treatment Needed (4)	Status Unknown (5)	No. (6)	Improvements Req'd (7)	Status Unknown (8)		
Municipalities	287	131	108	20	154	78	7	72	2
Industrial Plants	391	78	23	55	91	10	37	44	222
Total	678	209	131	75	245	88	44	116	224

NOTE: Columns 2, 3 and 4 include 20 municipalities which are presently unsewered but require sewer systems and treatment plants.

Particular note should be made of the 222 industries about which there are no data presently available. Not included in this group are an unknown number of mines and sawmills located in the Clark Fork-Pend Oreille and Kootenai River Basins about which little is presently known.

Estimated costs of treating sewage are available for a majority of the communities in the Columbia River Basin. Using these as a basis, it is estimated that the cost of constructing the necessary treatment facilities for 186 communities would be about $50,000,000. This includes the cost of treating industrial wastes discharged to community sewers, but does not include the cost of treating industrial wastes discharged separately. In the latter group, 33 plants are known to need treatment and insufficient data are available for determining the needs of 314 plants.

Along the Columbia River and its tributaries where water resources have been developed, are under construction or planned, these treatment facilities are necessary to assure adequate quality of the water. In irrigated valleys, where populations increase tremendously upon construction of irrigation facilities, the health of the people is dependent upon adequate disposal of domestic sewage. Development of recreational areas in connection with large impoundments such as Franklin D. Roosevelt Lake must await the removal of pollution from tributary streams. Likewise, harbor waters must be protected from oily scums and slicks in order to protect ships, boats and recreational craft.

Stream improvement benefits may be expected from proposed operation of certain Federal multiple-purpose projects. On the Willamette River, for example, summertime releases of flood-stored water would allow greater dilution of pollutional wastes discharged from adequate sewage and industrial waste disposal facilities.

THE COLUMBIA RIVER BASIN

PART II

BENEFITS AND COSTS

Pollution abatement will have great effect upon the economic developments and welfare of the people residing in the Columbia River Basin. Of primary importance will be the effect upon the health of the people. In the highly populated irrigated valleys, where many people by necessity use polluted streams and irrigation canals for domestic supply and irrigation of vegetable crops, enteric diseases have been frequent. The assurance of a better quality water for municipal and rural use in these areas will be of inestimable value. In other areas where surface waters are used for domestic supply, bathing and recreation, the benefits from pollution abatement will be of far-reaching importance.

Industries of the Columbia River Basin will reap a two-fold benefit from pollution abatement. It will materially reduce the cost of treating their process waters and in many instances permit the use of waters now unsatisfactory for process purposes. In addition, a number of industries will derive a profit from recovery of products now lost in the form of pollutional wastes. For example, the pulp and paper industry has been customarily losing about fifty percent of the raw wood material in its operation. Use of improved processes will permit recovery of this wood waste for heating or other use as well as possible recovery of chemicals used in making pulp. Many canneries, meat packing, milk products, beet sugar and other industrial plants are similarly in a position to recover saleable or useable products.

Fishery resources of the Columbia River Basin are less productive than in the past. Over-fishing and pollution by domestic sewage, mining and other industrial wastes are important causes for the reduction in the sports catch of game fish. Elimination of many miles of spawning streams by construction of dams, irrigation diversions, logging operations, mining and pollution as well as over-fishing are possible causes of the reduction in Columbia River salmon from an annual catch of more than 50 million pounds to the present level of about 30 million pounds. A concerted effort is now underway by local, State and Federal agencies to remove obstructions from lower Columbia River tributaries, provide adequate screening for irrigation canals and improve conditions for both

upstream and downstream migration of salmon and steelhead trout. Unless pollution is considerably reduced in some of these tributary streams these efforts will be of little value. Pollution abatement in the Willamette River and its tributaries will permit the reestablishment of a fall run of salmon.

In irrigated valleys along polluted watercourses of the Columbia River Basin, more than 26 million dollars worth of vegetable crops are harvested annually. Pollution abatement must be effective in these areas to safeguard the health of the people and protect the growers of these crops.

The tourist income of the Columbia River Basin is valued at more than $200,000,000 annually and is still growing. Unless protected from pollution the mountain streams, lakes and rivers will become unfit for bathing and boating and the Basin's economic developments retarded.

THE COLUMBIA RIVER BASIN

PART III

SPECIFIC POLICY PROBLEMS

The foremost need in the Columbia River Basin is a comprehensive approach to the development of its water resources. Existing developments have had one or more particular aims but have not coordinated all water uses to the best advantage. On a number of streams uses of water primarily for irrigation, and the resulting storage developments, have materially affected their use for domestic and industrial water supplies, fish, hydroelectric power, bathing and recreation. On others, developments for flood control and navigation have obstructed the migration of fish; on still others, hydroelectric power developments have had similar effects.

A report entitled "Review Report on Columbia River and its Tributaries," prepared by the Corps of Engineers, is the most comprehensive planning report now available. Insufficient consideration has been given in this report, however, to the use of water for domestic and industrial purposes, and the effects of pollution on various water uses.

In the 1,000,000-acre Columbia Basin Irrigation Project now under construction, adequate consideration has not been given to the future health of people who will reside in this area or to the sanitary quality of the crops they will ship to outlying markets. Because most of the existing streams dry up during summer months it may be necessary to provide complete sewage treatment for communities located in this project. In other irrigation areas of the Columbia Basin severe epidemics of enteric diseases have been of frequent occurrence. These could have been avoided by constructing sanitary facilities as irrigation projects developed. A study of the expected community growths, industrial expansion and sanitary facility requirements should be part of the irrigation development program in the Columbia Basin Project.

In addition to ore mining wastes, which seriously affect the downstream water uses on a number of streams, dredge mining operations on headwater streams destroy aquatic life and cause turbid conditions for many miles downstream. Corrective measures are needed to reduce the damages from these activities.

The suitability of many public supply watersheds has been adversely affected by uncontrolled logging operations. Usual damages are excessive turbidity and increased fluctuation in flow which require extensive treatment and provision of greater storage facilities. Voluntary or legal protection of such areas is desirable.

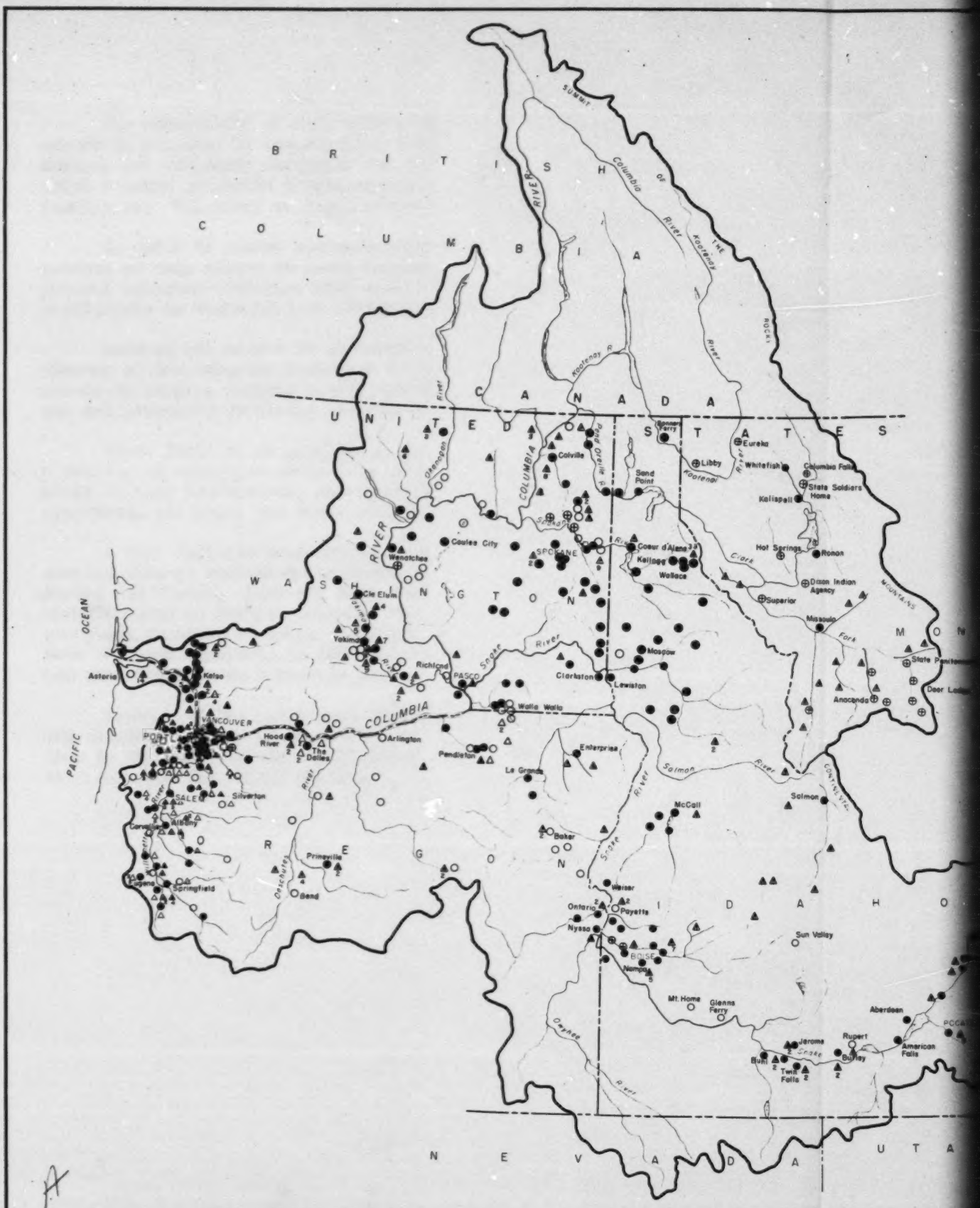
In order to assure adequate consideration of water pollution matters as they relate to basin development programs, State and Federal agencies concerned with water pollution control should participate in basic project planning.

Surveys are needed to determine the quality of water in various streams of the Columbia Basin and to determine the uses made of these waters by people, municipalities and industries. Sufficient funds are not presently available for this purpose.

There would be no problem of obtaining local participation in a program of pollution abatement. This subject is foremost in the minds of many individuals, sportsmen groups, industrial plant operators, and local and State officials.

A very definite need exists in the Columbia River Basin for coordination of pollution abatement programs between the United States and Canada. Lead and zinc mining operations along the Pend Oreille River in British Columbia and near Metaline Falls, Washington, are being expanded rapidly. Tailings from these mining operations, some of which originate in the United States, flow through Canada and into Franklin D. Roosevelt Reservoir.

Studies of the nature and amounts of wastes entering the river and possible methods of disposal back into the mines or places other than in the river should be initiated through joint participation of Canada and the United States.


BRITISH COLUMBIA
CANADA
UNITED STATES
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IDAHO
NEVADA
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Columbia River
Snake River
Kootenay River
Clark Fork
Salmon River
Spokane River
Pend Oreille River
Okanogan River
Yakima River
Deschutes River
Owyhee River
Boise River
Payette River
Bonner Ferry
Eureka
Libby
Whitefish
Columbia Falls
Kalispell
State Soldiers Home
Sand Point
Colville
Coulee City
Wenatchee
Ellensburg
Yakima
Richland
PASCO
Kennewick
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Rupert
Jerome
Burley
Buhl
Twin Falls
American Falls

Columbia River
Kootenay River
Rocky Mountains
Clark Fork
Salmon River
Snake River
Bear River
Owyhee River
Boise River
Payette River
Weiser River
Malheur River
Powder River
Continental Divide
Sand Creek
Portneuf River
Raft River
Goose Creek
Cassia Creek
Bruneau River
Owyhee
Bear
Boise
Payette
Weiser
Malheur
Powder
Baker
Wallowa
Enterprise
McCall
Salmon
Challis
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Ketchum
Hailey
Twin Falls
Jerome
Burley
Rupert
Mt Home
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Nampa
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Ontario
Nyssa
Aberdeen
American Falls
Pocatello
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Rexburg
St Anthony
Jackson
Driggs
Victor
Teton Pass
Teton Valley
Grand Teton
Yellowstone
Gardiner
Cooke City
Red Lodge
Billings
Bozeman
Livingston
Big Timber
Three Forks
Butte
Anaconda
Deer Lodge
Missoula
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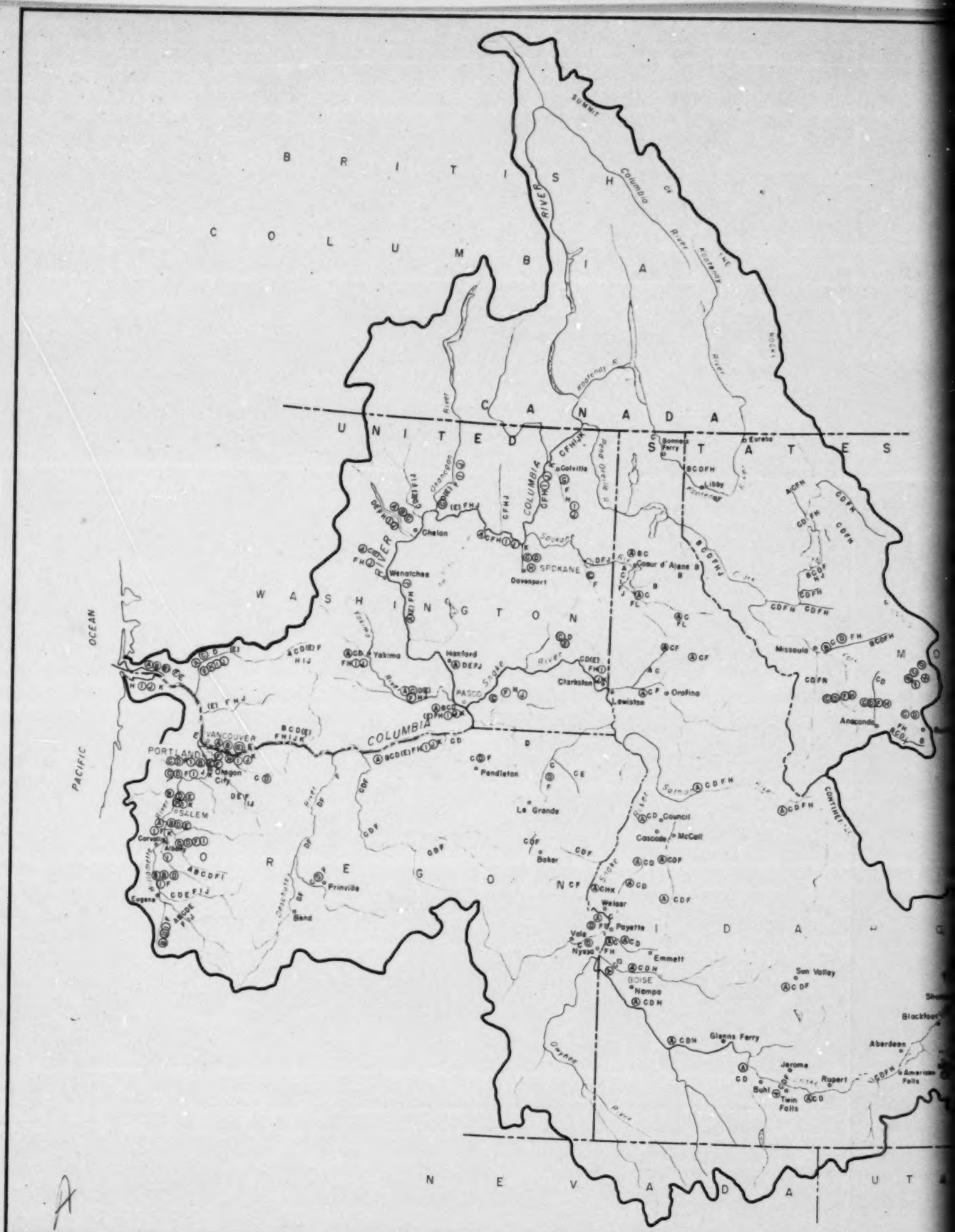
Ennis
Lewistown
Great Falls
Helena
Boulder
Whitehall
Townsend
Harlowton
Roundup
Miles City
Glendive
Sidney
Wibaux
Baker
Ekalaka
Broadus
Forsyth
Hardin
Custer
Hysham
Colstrip
Forsyth
Lame Deer
Ashland
Kalispell
Whitefish
Columbia Falls
Libby
Eureka
Bonners Ferry
Sandpoint
Priest River
Newport
Colville
Chewelah
Deer Park
Spokane
Coeur d'Alene
Kellogg
Wallace
Hot Springs
Ronan
Dixon Indian Agency
Superior
Moscow
Pullman
Clarkston
Lewiston
Grangeville
Orofino
Kamiah
Lapwai
Asotin
Dayton
Walla Walla
Pendleton
Hermiston
Umatilla
Boardman
Arlington
The Dalles
Hood River
Cascade Locks
Stevenson
Goldendale
Bingen
White Salmon
Klickitat
Trout Lake
Mount Adams
Mount Hood
Mount Jefferson
Mount St Helens
Mount Rainier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COLUMBIA RIVER
Columbia River
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Kootenai R.
Pend Oreille R.
Spokane R.
Snake River
Yakima R.
Deschutes R.
John Day R.
Grande Ronde R.
Salmon R.
Clearwater R.
Owyhee R.
Bonners Ferry
Eureka
Libby
Colville
Chelan
Wenatchee
SPOKANE
Davenport
Coeur d'Alene
Missoula
Anaconda
Yakima
Hanford
Pasco
Clarkston
Lewiston
Orofino
Pendleton
La Grande
Council
McCall
Cascade
Baker
Weiser
Payette
Vale
Nyssa
Emmett
Sun Valley
BOISE
Nampa
Glenns Ferry
Jerome
Rupert
Buhl
Twin Falls
American Falls
Blackfoot
Aberdeen
PORTLAND
Vancouver
Oregon City
SALEM
Corvallis
Albany
Eugene
Prineville
Bend

A DOMESTIC WATER SUPPLY
B INDUSTRIAL WATER SUPPLY
C LIVESTOCK WATER SUPPLY
D IRRIGATION WATER SUPPLY
E COMMERCIAL FISHING
(E) MIGRATION OF ANADROMOUS FISH
F GAME FISHING
H WILDLIFE
I BATHING WATER
J OTHER RECREATION
K NAVIGATION

○ WATER USE FOR WHICH STREAM IS UNSATISFACTORY IS ENCIRCLED

WATER USE AND ADEQUACY OF WATER FOR INDICATED USES IN THE COLUMBIA RIVER BASIN

FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE
DIVISION OF WATER POLLUTION CONTROL